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CLAIMS:

1. (Original) A pressure-compensating mass flow controller, said mass flow controller comprising:

a control valve;

a flow sensor; and

a pressure sensor positioned upstream from said control valve, wherein said control valve is operated based on signals from said flow sensor and from said pressure sensor.

2. (Original) The pressure-compensating mass flow controller of claim 1, wherein said flow sensor is positioned upstream from said control valve.

3. (Original) The pressure-compensating mass flow controller of claim 2, wherein said pressure sensor is positioned upstream of said flow sensor.

4. (Original) The pressure-compensating mass flow controller of claim 1, wherein said mass flow controller further comprises a filter.

5. (Original) The pressure-compensating mass flow controller of claim 4, wherein said filter is positioned upstream of said pressure sensor, said flow sensor and said control valve.

6. (Original) The pressure-compensating mass flow controller of claim 1, wherein said flow sensor is a thermal flow sensor.

7. (Original) The pressure-compensating mass flow controller of claim 1, wherein said mass flow controller comprises a display, said display displaying data based on said signal from said pressure sensor.

8. (Original) A process fluid control assembly comprising a pressure-compensating mass flow controller in accordance with claim 1; and

a first pneumatic valve positioned upstream of said pressure-compensating mass flow controller, said first pneumatic valve being adapted to control the flow of a fluid through the process fluid control assembly in response to a first pneumatic signal.

9. (Original) The process fluid control assembly of claim 8, comprising a manual shutoff valve upstream of said pressure-compensating mass flow controller.

10. (Original) The process fluid control assembly of claim 8, wherein said first pneumatic valve comprises a handle adapted for manual shutoff .

11. (Original) The process fluid control assembly of claim 8, wherein said first pneumatic valve comprises an actuator and a handle, wherein said actuator is adapted to move the valve, in response to a pneumatic signal, from a closed state into an open state, and wherein said handle is adapted to move said valve from said open state into said closed state regardless of whether a pneumatic signal is present.

12. (Original) The process fluid control assembly of claim 8, comprising a second pneumatic valve upstream of said pressure-compensating mass flow controller and a third pneumatic valve downstream of said pressure-compensating mass flow controller, said second and third pneumatic valves being adapted to control the flow of a fluid through the process fluid control assembly in response to second and third pneumatic signals.

13. (Original) The process fluid control assembly of claim 8, wherein said assembly does not comprise a pressure regulator.

14. (Original) A fluid control panel, comprising:

a substrate;. and

a plurality of process fluid control assemblies in accordance with claim 8 disposed on said substrate.

15. (Original) A combination manual/pneumatic valve for a fluid control assembly, the valve comprising:

a housing;

a valve chamber disposed in said housing, said valve chamber having a fluid inlet and a fluid outlet;

a pneumatically driven actuator adapted to move the valve, in response to a pneumatic signal, between a first state in which the flow of fluid between the fluid inlet and the fluid outlet is stopped, and a second state in which flow of fluid between the fluid inlet and the fluid outlet is permitted; and

a handle adapted to move said valve from the second state into the first state, regardless of whether a pneumatic signal is present at the actuator.

16. (Original) The valve of claim 15, wherein said handle is movable between a first position and a second position, and wherein said actuator is adapted to move said valve from the first state to the second state only when the handle is not in the second position.

17. (Original) The valve of claim 15, further comprising a diaphragm and a valve seat, and wherein the diaphragm is pressed against the valve seat when the valve is in said first state, thereby preventing the flow of fluid between the fluid inlet and fluid outlet.

18. (Original) The valve of claim 17, further comprising an expansion chamber having a piston therein which is adapted to press the diaphragm against the valve seat when no pneumatic signal is present at said actuator.

19. (Original) The valve of claim 18, wherein said housing is equipped with an air inlet adapted to receive a pneumatic signal, and an air outlet adapted to bring said expansion chamber to atmospheric pressure when said air outlet is brought into open communication with said expansion chamber.

20. (Original) The valve of claim 19, wherein said handle is movable between a first position and a second position, and wherein the piston is adapted such that the presence of a pneumatic signal withdraws the piston from the diaphragm only when the handle is not in the second position.

21. (Original) The valve of claim 20, wherein said air outlet is in open communication with said expansion chamber when the handle is in said second position.

22. (Original) The valve of claim 21, wherein said piston allows the diaphragm to move from a position in which it is pressed against the valve seat, to a different position, by advancing along a longitudinal axis in a first direction in response to a pneumatic signal.

23. (Original) The valve of claim 17, further comprising a spring adapted to maintain a compressive force on said diaphragm.

24. (Original) The valve of claim 15, wherein said handle is equipped with a threaded cylinder that rotatingly engages a complementarily threaded aperture in said housing.

25. (Original) The valve of claim 24, wherein said housing is equipped with an inlet adapted to introduce pressurized air into said expansion chamber, and an outlet adapted to exhaust said expansion chamber.

26. (Original) The valve of claim 25, wherein said handle has a shaft that is equipped with a passageway defined by first and second apertures that are in open communication with each other, and wherein said first aperture is in open communication with said expansion chamber.

27. (Original) The valve of claim 26, wherein said second aperture is adjustable, by rotation of said handle, from a first position in which it is in open communication with said inlet, to a second position in which it is in open communication with said outlet.

28. (New) A mass flow sensor for operation with a mass flow controller that includes an outlet control valve for controlling fluid flow through the controller, comprising:

a thermal mass flow sensor, including a sensor bypass, configured to sense the flow of fluid into the inlet of the controller;

a pressures sensor configured to sense the fluid pressure in the volume between the thermal mass flow sensor bypass and the control valve; and

an electronic controller configured to monitor the pressure sensed by said pressure sensor and to compensate the sensed inlet flow rate sensed by said mass flow sensor to thereby produce a compensated measure of the rate of fluid flow out of the controller.

29. (New) The mass flow sensor of claim 28 further comprising:

a temperature sensor configured to sense the temperature of fluid within the volume between the sensor bypass and the outlet control valve and to provide a signal indicative of the sensed temperature, the electronic controller configured to employ the temperature signal in producing the compensated rate of fluid flow.

30. (New) The mass flow sensor of claim 29, wherein the temperature sensor is configured to sense the temperature of a wall that defines a portion of the volume between the sensor bypass and the outlet control valve and to employ this sensed temperature to produce the temperature signal.

31. (New) The mass flow sensor of claim 30, wherein the electronic controller is configured to compute the time rate of change of pressure within the volume between the sensor bypass and the outlet control valve, and to use this time rate of change of pressure to produce the compensated measure of the rate of fluid flow out of the controller.

32. (New) The mass flow sensor of claim 28 further comprising a display configured to display the pressure within the volume between the sensor bypass and the outlet control valve.

33. (New) The mass flow sensor of claim 31 wherein the electronic controller is configured to

compare the compensated measure of the rate of fluid flow out of the controller to a set value and to adjust the outlet control valve to minimize the difference between the set value and the compensated measure of the rate of fluid flow out of the controller.

34. (New) The mass flow sensor of claim 33 wherein the electronic controller is configured to compensate the controller's sensed inlet flow rate by subtracting from the sensed inlet flow rate the product of: a normalized rate of pressure change within the volume between the sensor bypass and the outlet control valve, a normalized temperature of the fluid within that volume, and the volume between the bypass sensor and the outlet control valve.

35. (New) The mass flow sensor of claim 33 wherein the electronic controller is configured to compensate the controller's sensed inlet flow rate by subtracting from it the product of a constant, the volume between the sensor bypass and the outlet control valve, and the time rate of pressure change within the volume between the sensor bypass and the outlet control valve, divided by the temperature of the fluid within the volume.

36. (New) The mass flow sensor of claim 33 wherein the electronic controller is configured to compensate the controller's sensed inlet flow rate, Qi, by calculating the compensated sensed inlet flow rate, Qo, according to:

$Qo=Qi-C1(V/T)(dP/dt)$, where: Qo=the compensated sensed inlet flow rate, Qi=the sensed inlet flow rate, C1=a normalizing constant, V=the volume between the sensor bypass and the outlet flow control valve, T=the temperature of the fluid within the volume, and (dP/dt)=time rate of change of pressure within the volume.

37. (New) The mass flow sensor of claim 36 wherein the constant C1 is the resultant of the temperature at standard temperature and pressure divided by the pressure at standard temperature and pressure.

38. (New) A method of determining the outlet flow of fluid from a mass flow controller that includes an outlet control valve, comprising the steps of:

A) sensing and providing an indication of the flow of fluid into the inlet of the controller with a thermal mass flow sensor that includes a sensor bypass;

B) sensing and providing an indication of the fluid pressure in the volume between the thermal mass flow sensor bypass and the control valve;

C) an electronic controller monitoring the indication of pressure sensed in step B) for a period of time to obtain at least two pressure indications; and

D) the electronic controller compensating the indication of flow rate sensed in step A) based on the pressure monitored in step C).

39. (New) The method of claim 38 further comprising the step of:

E) sensing the temperature of fluid within the volume of step B) and providing a signal indicative of the sensed temperature.

40. (New) The method of claim 36 further comprising the step of:

F) the electronic controller employing the temperature signal of step E) in the compensating of the indication of flow rate of step D).

41. (New) The method of claim 36 wherein the step E) of sensing and providing an indication of the temperature of fluid within the volume comprises the step of:

E1) sensing the temperature of a wall that defines a portion of the volume between the sensor bypass and the outlet control valve.

42. (New) The method of claim 38, wherein the step D) of compensating comprises the step of:

D1) the electronic controller computing the time rate of change of pressure within the volume between the sensor bypass and the outlet control valve, and using the result to produce the compensated measure of the rate of fluid flow out of the controller.

43. (New) The method of claim 38 further comprising the step of:

G) displaying the pressure sensed in step B).

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44. (New) The method of claim 43 wherein the step G) of displaying the pressure includes the step of:

G1) displaying the pressure locally.

45. (New) The method of claim 43 wherein the step G) of displaying the pressure includes step of:

G2) displaying the pressure remotely.

46. (New) The method of claim 43 further comprising the steps of the electronic controller:

H) comparing the compensated measure of the rate of fluid flow out of the controller to a set value; and

I) adjusting the outlet control valve to minimize the difference between the set value and the compensated measure of the rate of fluid flow out of the controller.

47. (New) The method of claim 40 wherein the step F) of compensating the controller's indication of sensed inlet flow rate further comprises the step of:

F1) the electronic controller subtracting from the sensed inlet flow rate indication the product of: a normalized rate of pressure change within the volume between the sensor bypass and the outlet control valve, a normalized temperature of the fluid within that volume, and the volume between the bypass sensor and the outlet control valve.

48. (New) The method of claim 40 wherein the step F) of compensating the controller's indication of sensed inlet flow rate further comprises the step of:

F2) the electronic controller subtracting from the sensed inlet flow indication: the product of a constant, the volume between the sensor bypass and the outlet control valve, and the time rate of pressure change within the volume between the sensor bypass and the outlet control valve, divided by the temperature of the fluid within the volume.

49. (New) The method of claim 40 wherein the step F) of compensating the controller's indication of sensed inlet flow rate further comprises the step of:

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F3) the electronic controller compensates the controller's sensed inlet flow rate indication, Qi, by calculating the compensated sensed inlet flow rate, Qo, according to: Qo=Qi-C1(V/T)(dP/dt), where: Qo=the compensated sensed inlet flow rate, Qi=the sensed inlet flow rate, C1=a normalizing constant, V=the volume between the sensor bypass and the outlet flow control valve, T=the temperature of the fluid within the volume, and (dP/dt)=time rate of change of pressure within the volume.

50. (New) The method of claim 49, wherein the constant C1 is the resultant of the standard temperature (273.15 K), divided by the standard pressure, (760 Torr).

51. (New) A mass flow controller comprising:

an outlet control valve;

a thermal mass flow sensor, including a sensor bypass, configured to sense the flow of fluid into the inlet of the controller;

a pressures sensor configured to sense the fluid pressure in the volume between the thermal mass flow sensor bypass and the control valve; and

an electronic controller configured to monitor the pressure sensed by said pressure sensor and to compensate the sensed inlet flow rate sensed by said mass flow sensor to thereby produce a compensated measure of the rate of fluid flow out of the controller, the electronic controller further configured to employ the compensated measure of fluid flow out of the controller to produce a closed loop control signal for the outlet control valve.

52. (New) A mass flow controller according to claim 51 wherein the electronic controller is linked to a plurality of mass flow sensors and outlet control valves and provides closed loop control signals for the plurality of outlet control valves.